A SOIL SURVEY REPORT

of the

BOISE BASIN EXPERIMENTAL FOREST

by

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INTRODUCTION

Research on the Experimental Forest is primarily concerned with problems in the management of ponderosa pine. Perhaps one of the more important values of the soils information in this report will be that of furthering the general understanding of forest-soil relationships in this portion of the Intermountain Region.

Specifically, this report provides information for:

1. Distinguishing between soils for general research planning purposes such as location of study areas.

2. Determining the major soil differences or similarities within and between the different research areas of the Experimental Forest.

3. Extending research findings to other areas.

Intensive studies, including determination of the soils in small study plots, will require additional investigations and may require chemical and certain physical data not contained in this report.

SETTING OF THE EXPERIMENTAL FOREST

The Boise Basin Experimental Forest consists of the following three tracts 1/ of land within the boundaries of the Boise National Forest, near Idaho City, Idaho (see location map on following page):

Bannock Creek-Pine Creek tract	5,332 acres
Headquarters tract	780 "
Bear Run tract	1,270 "
Total	7,382 acres

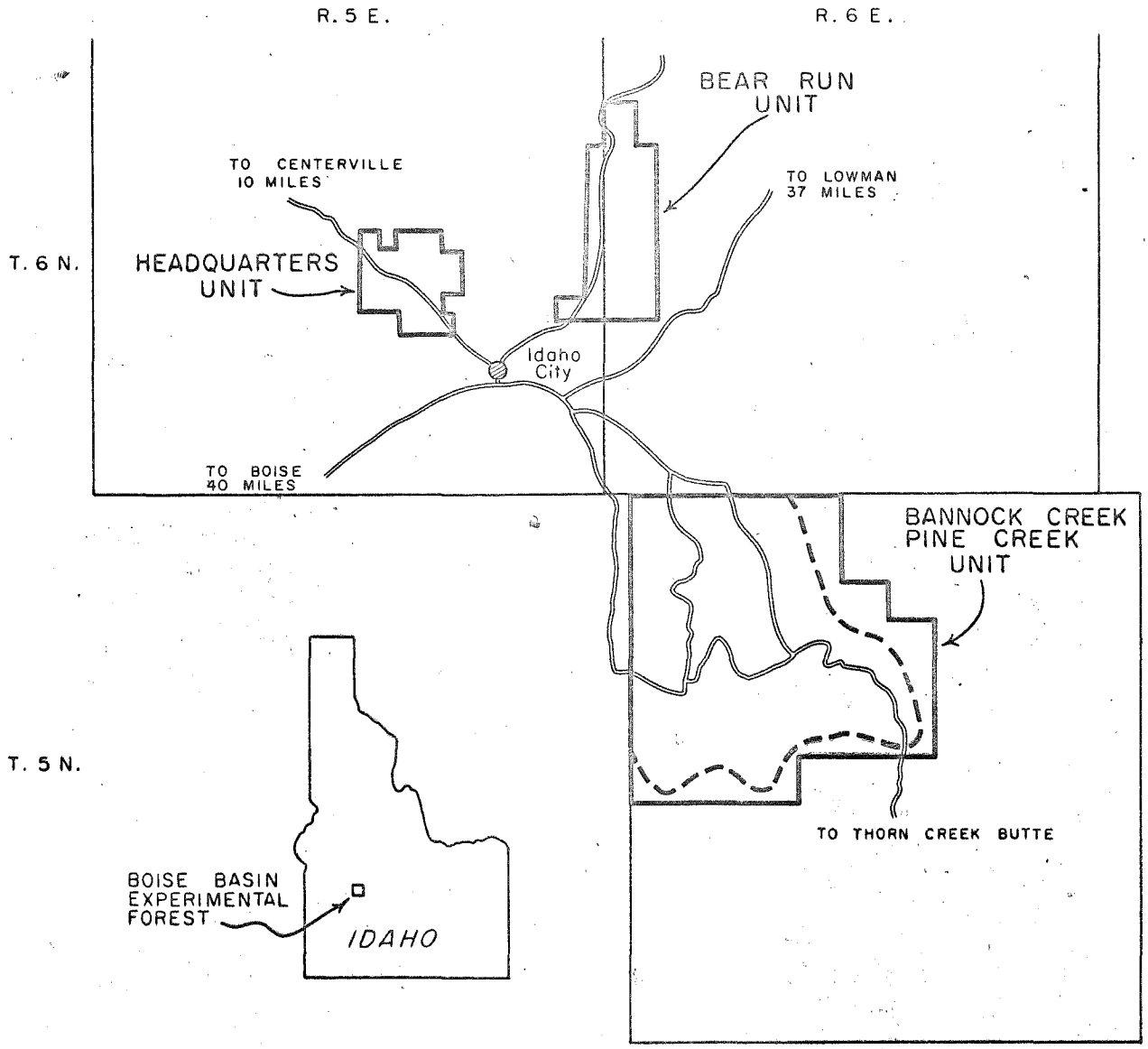
Geology. 2/ The Boise Basin is in the southwest part of the Idaho batholith. This batholith underlies about 16,000 square miles of central Idaho and western Montana. It was emplaced by magmatic injection during the Cretaceous period. The rock composition of the batholith ranges from quartz gabbro to granite, with an average between quartz monzonite and granodiorite. The rock units merge in most places without a mappable boundary. Most of the rocks are weathered to considerable depth. The degree of weathering varies from partially to thoroughly, and the degree of fracturing varies from none to intensely shattered. The overall patterns resulting from these rock composition changes and from changes in the degree of weathering, fracturing, and jointing are exceedingly complex and give rise to equally complex soil patterns.

The Boise Basin is structurally a downwarp with a northwest-southeast axis. The east and west sides of the basin are fault blocks. Upwarps lie to the north and south. Within the basin, the major ridges are due to irregularities in the original downwarp. The minor ridges, such as those in the Experimental Forest, are the product of stream dissection and mass wasting. Several minor faults are in the immediate vicinity of Idaho City.

Quartz monsonite is the principal rock type in the Experimental Forest. This is a coarse-grained, light gray to nearly white rock with less than 5 percent dark minerals. It weathers into sandy and moderately sandy soil materials. Very dark to nearly white porphyritic dikes intruded the quartz monzonite mass throughout the Experimental Forest.

1/ To avoid confusion, the term "tract" is used with the names of the various experimental areas rather than the official term "unit." In this report, the term "unit" is used with soils and rocks such as the soil units and rock units (taxonomy) and the soil mapping units (geography).

2/ Anderson, Alfred L. 1947. Geology and Ore Deposits of Boise Basin, Idaho. U. S. Geological Survey Bulletin 944-C.



LOCATION MAP

BOISE BASIN EXPERIMENTAL FOREST

Some aplite and a few, very small lamprophyre dikes are also scattered through the surveyed areas. The porphyritic and aplitic rocks contain considerable clay-forming minerals and weather into relatively clayey soil materials.

Remnant patches of lower Miocene lakebed sediments are in the Headquarters and Bear Run tracts. Where intact and unadulterated, this material consists of stratified clays with sandy streaks, lignitic shale layers, and gravel seams. These sediments make up the clay spots in the Headquarters tract.

Relief. The Bannock Creek-Pine Creek tract is adjacent to the boundary of the structural basin and consequently has higher elevations than the other two tracts. The elevational extremes in this tract are about 6,800 feet and 4,400 feet. The high and low elevations in the Headquarters tract are about 4,670 feet and 4,000 feet, and about 4,920 feet and 4,080 feet in the Bear Run tract.

With the exception of a small portion of the Bear Run tract, all of these lands are well dissected by drainages. The topography is classed as mature. Ridgetops are narrow and slopes are steep. The valley bottoms are mostly V-shaped and flood plains are not extensive.

The intricate pattern of dissection is accompanied by a similarly intricate pattern of soil mantle thickness. The soils are mainly shallow on convex surfaces such as on the crests, ridges, peaks, and microdivides of the side slopes. Deep soils are generally associated with the concave surfaces such as the toe slopes, swales, and in drainageways. The depth to bedrock may vary from a few inches on the ridgetop to several feet on the toe slope. However, soil thickness or depth is not always related to the distance downslope from the ridgetop. Changes in surface configuration anywhere on a slope are accompanied by changes in the thickness of the soil. The causes for changes in surface configuration are probably directly related to differences in rock weathering and geologic erosion.

Climate. 3/ The average annual precipitation at Idaho City, Idaho, (elevation, 3,965 feet) is slightly more than 23.0 inches. Most of this precipitation falls during the winter months. At this same location, the average January temperature is about 23° F. and the average August temperature is about 65° F. The average annual temperature is about 45° F.

3/ U. S. Department of Commerce, 1963. Climatological Data. Idaho Annual Summary, Vol. 66, No. 13.

SOILS AND MISCELLANEOUS LAND TYPES

Eight soil units and two miscellaneous land types are recognized on the Experimental Forest. The following key shows the primary criteria used to separate the soils and the general relationship between them.

Soil Units	Soil Unit No. or Map Symbol
Upland Soils	
Fractured (permeable) bedrock	
Sandy subsoils 4/	1
Coarse loamy subsoils 4/	2
Fine loamy subsoils 4/	3
Massive (relatively impermeable) bedrock	
Sandy subsoils	4
Coarse loamy subsoils	5
Fine loamy subsoils	6
Alluvial Soils	
Well drained	7
Imperfectly drained	8
Miscellaneous Land Types	
Made Land (placer tailings)	ML
Clay Spots	⁂

Additional differentiating characteristics supporting the separations shown above include thickness and texture of the surface horizons, soil reaction, consistence, and structure.

4/ The texture of the subsoil (or the 10- to 30-inch layer if no subsoil is present or of the entire solum if the soil is very shallow to bedrock) is given in terms of textural groups. See texture triangle in appendix for the sand-silt-clay limits of each. All textural terms in this report follow the U.S.D.A. system; the classes were determined by conventional field appraisal methods.

On a group level, the soils have distinctive landscapes. The upland soils overlying fractured bedrock present a forested appearance in contrast to a nonforested appearance of the upland soils overlying massive bedrock. The landscape contrast between the upland soils and the alluvial soils in regard to topographic characteristics is always striking. Finally, the well-drained alluvial soils are timbered, and the imperfectly drained alluvial soils support meadow vegetation.

Within these groups, however, the individual soil units are distinctive from each other only in a general or average way. For example, the three upland soil units overlying fractured granitic rock have overlapping topographic characteristics and all support similar kinds of vegetation. The average slope gradient of the soils in unit No. 1 is greater than the average for soil unit No. 2, which in turn is greater than the average for soil unit No. 3. Likewise, the growth rates of ponderosa pine are higher on the soils of unit No. 3 than on the soils of unit No. 2 or unit No. 1, but the range of site indices of each soil overlaps the ranges of the others.

The precise location of many soil boundaries was difficult to follow out because of the complex and intricate soil patterns that exist. Even though the soil maps show symbols representing single soil units within most of the delineated areas, rarely do any of the soils occur as pure units over extensive areas. In the following soil descriptions, therefore, each soil classification unit is discussed first in regard to its typical range of profile characteristics and then in regard to the mapped and unmapped soils closely associated with it. The unmapped "inclusions" can be very significant in research areas where small plots are commonly studied.

Soil Unit No. 1 - The Sandy Upland Soils Overlying Fractured Granitic Bedrock.

These soils have developed from coarse textured granitic rocks. The principal parent rock is probably quartz monzonite. The slopes upon which these soils have developed mainly vary in gradient between 30 percent to over 65 percent with the average gradient probably more than 50 percent. Most of these soils occur in the Bannock Creek-Pine Creek tract.

The surface horizons of these soils are grayish brown, gravelly (or coarse) sandy loams. These horizons grade through sandy transitional horizons into fractured, permeable bedrock. Depth to the root-penetrated bedrock material varies primarily with topographic position. These soils typically are about 6 to 10 inches deep on the ridges, about 18 to 24 inches deep on the smooth midslope positions, and may exceed 40 inches on the toe slopes. Soil reaction is acid throughout all horizons.

The vegetation associated with these soils is predominantly conifer forests. Southerly aspects support ponderosa pine stands with varying amounts of snowberry, chokecherry, willow, bitterbrush, ceanothus, and serviceberry.

Northerly aspects support dense stands of Douglas-fir with very minor amounts of ponderosa pine. Stony phases of these soils on north aspects commonly support understories that are dominated by ninebark and shrub maple. A few small areas are nonforested and support dense stands of brush.

Below are typical descriptions 5/ of some profiles in this soil unit.

Ridge position (on a descending spur), south aspect:

O1	2"	Litter including 1/2 inch of fresh needle cast and 1 1/2 inches of partially decomposed needles and twigs; contains some sand and gravel particles.
A1	0-3"	Grayish brown (10YR 5/1.5 dry) to very dark grayish brown (10YR 3/1.5 moist) gravelly light sandy loam; weak, fine granular; soft, very friable, nonsticky; plentiful roots; medium acid (pH 6.0); abrupt, wavy boundary.
AC	3-8"	Light brownish gray (10YR 6/2.5 dry) to dark grayish brown (10YR 4/2 moist) gravelly loamy sand; weak, medium subangular blocky breaking to weak, fine granular; soft, very friable, nonsticky; plentiful roots; medium acid (pH 6.0); clear, wavy boundary.
C	8-13"	Light gray (10YR 7/2 dry) to grayish brown (10YR 5/2 moist) very gravelly loamy sand; very weak medium subangular blocky structure; soft, very friable, nonsticky; plentiful roots; medium acid (pH 6.0); gradual, irregular boundary.
CR	13"+	Well weathered, fractured, granitic rock material; penetrated by all sizes of roots to observed depths of more than 20".

Side slope position, 39 percent gradient, south aspect:

O1	1/4"	Loose litter of pine needles.
A11	0-1"	Dark grayish brown (10YR 4/2 dry) to very dark grayish brown (10YR 3/2 moist) very (fine) gravelly sandy loam; weak, fine granular structure; loose, very friable, nonsticky; few roots; medium acid reaction (pH 6.0); abrupt, smooth boundary.

5/ The soil descriptions follow the standardized format and classes used by the National Cooperative Soil Survey. Color designations and terms are Munsell notations; reaction was determined colorimetrically by the Hellige-Truogg method. For definition of other terms, see FSH 50 (Soils) or for a more complete treatise, see U.S.D.A. Soil Survey Handbook, No. 18.

A12	1-4"	Dark grayish brown (10YR 4/2 dry) to very dark grayish brown (10YR 3/2 moist) gravelly sandy loam; weak, fine granular; soft, friable, nonsticky; plentiful roots; medium acid (pH 6.0); clear, wavy boundary.
A13	4-8"	Grayish brown (10YR 5/2 dry) to very dark grayish brown (10YR 3/2 moist) gravelly sandy loam; weak, medium subangular blocky; soft, friable, nonsticky; plentiful roots; medium acid (pH 5.9); clear, wavy boundary.
AC	8-24"	Light brownish gray (10YR 6/2 dry) to dark grayish brown (10YR 4/2 moist) gravelly light sandy loam; weak, medium subangular blocky, soft, friable, nonsticky; plentiful roots; strongly acid (pH 5.5); clear, wavy boundary.
C	24-28"	Light brownish gray (10YR 6/2 dry) to dark grayish brown (10YR 4/2 moist) gravelly loamy sand; loose, very friable, nonsticky; plentiful roots, medium acid (pH 6.0); clear, wavy boundary.
CR	28"+	Well weathered, fractured, granitic bedrock material; penetrated by roots.

Lower side slope position, 60 percent gradient, east aspect:

O1	1 1/2-1"	Loose, partially decomposed needles.
O2	1-0"	Well decomposed, soft, matted duff.
A11	0-4"	Grayish brown (10YR 5/2 dry) to very dark grayish brown (10YR 3/2 moist) gravelly light sandy loam; weak, fine granular structure; loose, very friable, nonsticky; abundant roots; medium acid (pH 6.0).
A12	4-6"	Light brownish gray (10YR 6/2 dry) to very dark grayish brown (10YR 3/2 moist) very gravelly light sandy loam; weak, medium subangular blocky structure breaking to weak fine granular; soft, friable, nonsticky, plentiful roots; medium acid (pH 6.0).
AC	6-10"	Light brownish gray (10YR 6.5/2 dry) to dark grayish brown (10YR 4/2 moist) gravelly loamy sand; very weak medium subangular blocky; soft, friable, nonsticky; plentiful roots; medium acid, (pH 6.0).
C	10-38"+	Very pale brown (10YR 7/3 dry) to dark grayish brown (10YR 4/2 moist) gravelly loamy sand; massive; slightly hard, friable, nonsticky; few roots; medium acid (pH 6.0)

These soils are closely associated with the soils of unit No. 2, and most of the areas mapped as soil unit No. 1 contain varying amounts of the second unit as small intermingled bodies. Stony phases of soil unit No. 1 occur mainly on the headwater slopes of Bannock Creek, where some of the profiles contain about 25 percent by volume of cobble and stone-sized (3 to 20 inches in diameter) rock fragments. A few rock outcrops are associated with this soil unit.

Soil Unit No. 2 - Coarse Loamy Upland Soils Overlying Fractured Granitic Bedrock.

The soils of this unit have developed on slopes whose gradients most commonly vary between 20 and 60 percent. The average gradient is likely somewhat less than 50 percent. The underlying quartz monzonite rocks appear to be similar to those underlying the sandy soils just described, but appear to have a slight increase in the volume percentage of clay-forming minerals, and the rocks tend to be finer-grained. Some appear to have been slightly altered chemically or hydrothermally.

These soils have gravelly sandy loam surfaces and sticky sandy loam subsoils. The amount of clay in the subsoils varies from a trace (enough clay flows to be noticeable with a hand lens and feel when wet) to a heavy sandy loam that is definitely sticky and has noticeable "body." The thickness of the soil mantles varies mainly with the topographic (both macro and micro) position, but it also varies somewhat with aspect. The ridge positions have soils that are mainly between 7 and 12 inches to bedrock; the south facing slopes dominently vary between 10 and 30 inches and the north facing slopes between 15 and 40 inches to bedrock. All soil horizons are generally acid in reaction, and commonly the subsoils are more acid than the surfaces.

The vegetation on these soils is similar in composition to that on soil unit No. 1. Ponderosa pine stands dominate the southerly aspects and Douglas-fir dominate the northerly ones.

Below are descriptions of some typical soil profiles in this soil unit.

Ridge position, slope gradient about 5 percent, south aspect.

O1	1-0"	Litter layer; includes both fresh and partially decomposed materials--mostly pine needles.
A1	0-4"	Grayish brown (10YR 5/2 dry) to very dark grayish brown (10YR 3/2 moist) gravelly sandy loam; weak, fine granular; soft, friable, nonsticky; plentiful roots; medium acid (pH 5.8); clear, irregular boundary.
B2t	4-12"	Light brownish gray (10YR 6/2 dry) to dark grayish brown (10YR 4/2 moist) very gravelly heavy sandy

loam; weak, medium subangular blocky; slightly hard, friable, sticky; faint, patchy clay films on the gravels and in the cavities; plentiful roots; medium acid (pH 6.0); abrupt, irregular boundary.

CR	12"+	Well-weathered, fractured granitic bedrock; penetrated by fine and coarse roots. Depth to bedrock in this particular pit varies from 10 inches to 24 inches within a distance of 3 feet.

Side slope, 20 percent slope gradient, west aspect:

O1	1-0"	Litter layer; mostly pine needles.
A11	0-2"	Dark grayish brown (10YR 4/2 dry) to very dark grayish brown (10YR 3/2 moist) gravelly sandy loam; weak fine granular; soft, friable, nonsticky; abundant roots; neutral reaction (pH 7.0); abrupt, wavy boundary.
A12	2-6"	Dark grayish brown (10YR 4/2 dry) to dark brown (10YR 3/3 moist) gravelly sandy loam; weak fine subangular blocky breaking to weak medium granular; soft, friable, nonsticky; plentiful roots; medium acid (pH 6.0); clear, wavy boundary.
B2t	6-17"	Brown (10YR 4/3 dry) to dark yellowish brown (10YR 3/4 moist) gravelly heavy sandy loam; moderate, medium subangular blocky; hard, firm, slightly sticky; faint, patchy clay films in the cavities; few roots; medium acid (pH 5.8); clear, wavy boundary.
B3	17-34"	Pale brown (10YR 6/3 dry) to brown (10YR 4/3 moist) gravelly loamy sand; weak, fine subangular blocky; soft, friable, slightly sticky; very few roots; medium acid (pH 5.6); gradual, wavy boundary.
CR	34"+	Well-shattered granitic bedrock; easily crushed to a gravelly sand; penetrated by coarse roots.

In the Bannock Creek-Pine Creek tract, these coarse loamy soils appear geographically as the transitional soils between the sandy units and the fine loamy units (all overlying the fractured bedrocks). Either of these two latter soil units may be the dominant inclusion (unmapped) with the soils of unit No. 2 in this tract. In the Headquarters tract, small bodies of soil unit No. 3, each an acre or two in size, are scattered throughout most of the areas mapped as soil unit No. 2. This is also typical of the coarse loamy soils in the Bear Run tract--the dominant inclusions in the mapping units of soil unit No. 2 are soil unit No. 3.

Soil Unit No. 3 - Fine Loamy Upland Soils Overlying Fractured Granitic Bedrock.

The soils of this unit have developed most commonly on slopes whose gradients are less than 45 percent. A considerable area of these soils in the Bear Run tract are on slopes with gradients of less than 10 percent. The underlying rock substrata are fine grained rocks relatively high in clay-forming minerals. Included rock types appear to be monzonites, chemically or hydrothermally altered granitics, porphyries, and aplites. The term "fractured granitic bedrock" is used here to include all bedrocks that are fractured and/or permeable and that are in, or are closely related to, the granitic suite of rocks.

The surface layers of these soils are dark loams and subsurface A2 horizons are present in places. The subsoils are sandy clay loams. The thickness of the soil mantle is related to position on the slope and to the weathering characteristics of the parent rocks. Soils on the ridgetops are as shallow as 10 inches. Depth to the well-weathered bedrock on the side slope positions is in the range of 24 to 72 inches. Most of the profiles are stone-free, but some stoniness is characteristic of the soils on the ridgetops. Soil reaction is acid in all horizons.

Ponderosa pine is the dominant tree species on all aspects except possibly north; but even here, it commonly occupies a codominant position with Douglas-fir. The understory shrub species include snowberry, serviceberry, bitterbrush, willow, chokecherry, ninebark, and Oregon grape. Common forbs are yarrow, lupine, geranium, balsamroot, potentilla, and galium. Small stands of aspen occur in a few locations. Fire has removed the forest canopy on some of these soils in the Headquarters tract.

Ridge position (on a descending spur), 27 percent slope gradient, west aspect:

O1	1/2"	Litter layer; mostly fresh and partially broken up needles and twigs.
A11	0-2"	Dark grayish brown (10YR 4/2 dry) to very dark brown (10YR 2/2 moist) very gravelly loam; weak, fine granular; soft, friable, nonsticky; few roots; slightly acid (pH 6.5); abrupt, smooth boundary.
A12	2-4"	Dark brown (10YR 3/3 dry) to very dark brown (10YR 2/3 moist) gravelly loam; very weak, fine subangular blocky breaking to weak, medium granular; soft, friable, slightly sticky; few roots; slightly acid (pH 6.5); abrupt, smooth boundary.
B2t	4-10"	Brown (10YR 4/3 dry) to dark brown (10YR 3/3 moist) gravelly light sandy clay loam; weak, medium subangular blocky; slightly hard, friable, slightly sticky; faint patchy clay films on the peds and in the pores; very few roots; medium acid (pH 6.0); abrupt, wavy boundary.

CR	10"+	Well-weathered, soft granitic bedrock; yellowish brown (10YR 5/4); contains some filled root or rodent channels; penetrated by a few roots.

Side slope position, 40 percent slope gradient, southwesterly aspect:

O1	1 1/2-1"	Fresh and partially decomposed needles and twigs.
O2	1-0"	Well decomposed litter materials.
A1	0-4"	Dark grayish brown (10YR 4/2 dry) to very dark brown (10YR 2/2 moist) loam; very weak fine subangular blocky breaking to weak medium granular; soft friable, slightly sticky; plentiful roots; medium acid (pH 6.0); abrupt, wavy boundary.
A2 & B2t	6-16"	Brown (10YR 5/3 dry) to dark brown (10YR 3/3 moist) sandy loam interlayered with brown (10YR 5/3 dry) to dark grayish brown (10YR 4/2 moist crushed) sandy clay loam; the sandy loam portions are dominant and have weak, medium subangular blocky structure, are slightly hard, friable, slightly sticky, have few roots, and are medium acid (pH 6.0); the sandy clay loam portions have weak, medium subangular blocky structure; are hard, friable, slightly sticky, contains few roots; and are medium acid (pH 6.0); abrupt, wavy boundary.
B2t	16-23"	Brown (7.5YR 5/4 dry) to dark brown (7.5YR 3/4 moist) heavy sandy clay loam; moderate, medium subangular blocky; hard, firm, sticky, plastic; distinct, broken clay films on the peds; few roots, slightly acid (pH 6.1); abrupt, wavy boundary.
B3	23-35"	Brown (10YR 5/3 dry) to dark brown (10YR 4/3 moist) sandy clay loam; very weak, medium subangular blocky; hard, slightly firm, sticky; faint, patchy clay films in the cavities; few roots; slightly acid (pH 6.1); abrupt, wavy boundary.
CR	35-50"	Well-weathered, very soft granitic bedrock; easily crushed to gravel and sand particles; faint, patchy clay films in some of the root channels; few roots. The bedrock is distinctly harder below 50".

Side slope position, 45 percent slope gradient, northwesterly aspect:

O1	1/2"	Fresh litter material of needles and twigs.
O2	1"	Partially and well decomposed duff layer.

A11	0-3"	Very dark grayish brown (10YR 3/2 dry) to very dark brown (10YR 2/2 moist) loam; weak, fine subangular blocky breaking to weak, medium granular; soft, friable, slightly sticky; plentiful roots; medium acid (pH 6.0); clear, smooth boundary.
A12	3-10"	Brown (10YR 4/3 dry) to dark brown (10YR 3/3 moist) heavy loam; weak, medium subangular blocky; slightly hard, friable, slightly sticky; plentiful roots; slightly acid (pH 6.5); clear, smooth boundary.
A2	10-24"	Pale brown (10YR 6/3 dry) to brown (10YR 4/3 moist) heavy very fine sandy loam; moderate, medium subangular blocky; slightly hard, friable, slightly sticky; few roots; few fine pores; slightly acid (pH 6.5); clear, smooth boundary.
B1	24-35"	Pale brown (10YR 6/3 dry) to brown (10YR 4/3 moist) heavy loam to silt loam; very weak prismatic structure breaking to moderate, medium subangular blocky; hard, slightly sticky, slightly plastic; few roots; few fine pores; slightly acid; gradual wavy boundary.
B2t	35-52"	Brown (10YR 5/3 dry) to dark brown (10YR 4/3 moist) clay loam or sandy clay loam; moderate, medium blocky; hard, firm, sticky, slightly plastic; distinct, broken clay films in the pores; few roots; abundant pores; strongly acid (pH 5.5); clear, smooth boundary.
B3	52-58"	Very pale brown (10YR 7/3 dry) to brown (10YR 4/3 moist) gravelly loam; weak, medium subangular blocky; slightly hard, friable; slightly sticky; few roots; very few fine pores; medium acid (pH 6.0); gradual, smooth boundary.
C1	58"+	Light yellowish brown (10YR 6/4 dry) very gravelly loamy sand; medium acid (pH 6.0).

In the Bannock Creek-Pine Creek tract, most of the mapped areas of this soil unit contain small inclusions of soil unit No. 2--the coarse loamy upland soils overlying fractured granitic bedrock. The area containing the largest proportion of these inclusions is in section 6 where the coarse loamy soils occupy portions of the south facing slopes and some ridges. These inclusions account for about 25 percent of the mapping unit in this particular area.

Soil Unit No. 4 - Sandy Upland Soils Overlying Massive Granitic Bedrock.

These soils have developed on massive and apparently impermeable or only slowly permeable granitic bedrock. The rocks appear to be mainly quartz monzonites. They are weathered but are relatively unfractured. Jointing,

where evident, appears mostly as horizontal planes. The penetration of plant roots seems to be restricted essentially to the solum. The slopes upon which the soils of this unit have developed are typically convex and have 25 to 50 percent gradients. Southerly aspects are dominant but all aspects are present.

The vegetation dominantly consists of shrubs, forbs, and grasses. The principal species include big sagebrush, bitterbrush, chokecherry, rabbitbrush, eriogonum, lupine, cheatgrass, wheatgrass, and annuals. A few ponderosa pine and Douglas-fir trees are on these soils but nowhere are in sufficient numbers to be considered a stand.

These soils have gravelly sandy loam surface horizons and gravelly loamy sand transitional or subsoil horizons. They do not have any textural development in the subsoils. Depth to bedrock may average about 24 inches but varies from as little as six inches on the ridges to more than 40 inches on some lower slopes. The dark surface horizons are relatively thick (up to 20 inches or more on the deeper profiles). A few rock outcrops are associated with these soils.

Descriptions of two typical profiles in this unit follow.

Descending spur ridge position, 25 percent slope gradient, south aspect:

A11	0-1"	Grayish brown (10YR 5/2 dry) to very dark grayish brown (10YR 3/2 moist) loamy coarse sand; very weak fine granular; loose, very friable, nonsticky; about 20 percent of the surface is covered by coarse sands or fine gravels; medium acid (pH 6.0); clear, smooth boundary.
A12	1-6"	Dark grayish brown (10YR 4/2 dry) to very dark grayish brown (10YR 3/2 moist) fine gravelly light sandy loam; weak, fine granular, soft, very friable, nonsticky; few roots; medium acid (pH 6.0); abrupt, smooth boundary.
AC	6-10"	Brownish yellow (10YR 6/6 dry) to yellowish brown (10YR 5/6 moist) heavy loamy sand; weak, fine subangular blocky breaking to weak fine granular; soft, friable, nonsticky, plentiful roots; medium acid (pH 6.0); clear, wavy boundary.
C1	10-13"	Light yellowish brown (10YR 6/4 dry) to yellowish brown (10YR 5/4 moist) fine gravelly sand; massive; slightly hard, friable, nonsticky; few roots; medium acid (pH 6.0); abrupt, irregular boundary.
R	13"+	Hard, massive granitic bedrock with essentially no root penetration.

Upper side slope position, 26 percent slope gradient, south aspect:

A11	0-4"	Dark gray brown (10YR 4/2 dry) to very dark gray brown (10YR 3/2 moist) gravelly light sandy loam; weak, fine granular; loose, nonsticky; abundant roots; neutral (pH 6.7); abrupt, wavy boundary.
A12	4-19"	Colors as above; gravelly sandy loam; weak, fine granular; soft, friable, nonsticky; plentiful roots; slightly acid (pH 6.5); clear, wavy boundary.
AC	19-29"	Gray brown (10YR 5/2 dry) to brown (10YR 4/3 moist); gravelly light sandy loam in the upper portion, gravelly loamy sand in the lower; soft, very friable, nonsticky; plentiful roots; slightly acid (pH 6.3); clear, irregular boundary.
R	29"+	Massive, weathered granitic bedrock; upper few inches can be cut with a knife.

Only on the Bear Run tract have these soils been mapped as a single unit. On the Bannock Creek-Pine Creek tract, where these soils dominantly occur, they are everywhere mapped in association with the soils of unit No. 5--the coarse loamy upland soils overlying massive granitic bedrock. (See discussion of the 5-4 mapping unit on page 16.)

Soil Unit No. 5 - Coarse Loamy Upland Soils Overlying Massive Granitic Bedrock.

These soils have developed on slopes with gradients typically in the range of 25 to 65 percent. The physical nature of the bedrock is essentially similar to that underlying the soils described above (soil unit No. 4). The general appearance of the bedrock in roadcuts is massive with some horizontal jointing evident. The composition of the rocks, however, may differ slightly in the amount of clay forming minerals.

Vegetation is dominantly a shrub-forb-grass mixture. The principal species are chokecherry, bitterbrush, bittercherry, snowberry, big sagebrush, serviceberry, rabbitbrush, eriogonum, balsamroot, lupine, cheatgrass, bluebunch wheatgrass, and annuals. Ponderosa pine and Douglas-fir trees occur as scattered individuals.

The surface horizons of these soils are gravelly sandy loams; the subsoils are also gravelly sandy loams but contain sufficient clay so as to be sticky when wet. Depth to bedrock may be as shallow as five inches on the ridges and is commonly about 30 inches on the side slopes and 40 inches or more on the lower slopes and on the slightly concave topographic surfaces. Soil surface horizons average perhaps 10 inches in thickness. In places, the subsoil horizons lie abruptly on the massive bedrock substrata. More commonly, however, a thin transitional horizon exists and consists of

broken or fissured bedrock and some subsoil material. This, in turn, is underlain by the massive granitic bedrock stratum.

Descriptions of two typical profiles in this soil unit follow.

Side slope position, 60+ percent slope gradient, west aspect:

A1	0-12"	Grayish brown (10YR 5/2 dry) to very dark grayish brown (10YR 3/2 moist) gravelly sandy loam; moderate fine granular; soft, friable, nonsticky; abundant roots; slightly acid (pH 6.2); clear, wavy boundary.
B1	12-24"	Pale brown (10YR 6/3 dry) to brown (10YR 5/3 moist) gravelly light sandy loam; weak, medium subangular blocky; hard to slightly hard, friable, nonsticky; volume of rock fragments (3 to 12 inches diameter) about 5 percent; plentiful roots; slightly acid (pH 6.2); abrupt boundary. The 21-24" part of this horizon at this location is a root or rodent channel which is filled with the dark soil from above.
R & B2t	24-36"	This horizon is about 85 percent weathered rock and 15 percent soil. The soil material is very pale brown (10YR 7/2 dry) to light brownish gray (10YR 6/2 moist) very gravelly heavy sandy loam; weak, fine subangular blocky; slightly hard, friable, sticky; patchy clay films on the upper surfaces of the rock fragments; plentiful roots; clear, irregular boundary.
R	36"+	This horizon is about 99 percent rock; fine root mats are in some shallow fissures. The general appearance of the granitic bedrock as observed in the deep roadcut is massive with weakly expressed horizontal jointing.

Side slope position, 40 percent slope gradient, southwest aspect:

A11	0-3"	Dark gray brown (10YR 4.5/2 dry) to very dark gray brown (10YR 3/2 moist) gravelly sandy loam; moderate, fine granular; soft, friable, nonsticky; slightly acid (pH 6.2).
A12	3-6"	Dark gray brown (10YR 4.5/2 dry) to very dark gray brown (10YR 3/2 moist) gravelly sandy loam; weak, medium subangular blocky; slightly hard, friable, nonsticky; slightly acid (pH 6.2).
B2t	6-13"	Brown (10YR 5/3 dry) to dark brown (10YR 3/3 moist) gravelly heavy sandy loam; weak, fine subangular

		blocky; slightly hard, slightly sticky; medium acid (pH 6.0).
R	13"+	Well weathered granitic bedrock, penetrated by roots in the upper two inches; hardness of the rock increases with depth.

These soils were mapped only in the Bannock Creek-Pine Creek tract. They occur both as relatively pure units (soil symbol 5 on the map) and in association with soil unit No. 4 (soil symbol 5-4 on the map). In the 5-4 areas, the two soils are intermingled with little or no distinctive pattern of occurrence. Based on random sampling, it appears that soil unit No. 5 occupies about 60 percent of the 5-4 mapping unit and soil unit No. 4 occupies about 30 to 35 percent. The remaining percentage of the 5-4 mapping unit consists of soils similar to the fine loamy upland soils overlying massive granitic bedrock (soil unit No. 6).

Soil Unit No. 6 - The Fine Loamy Upland Soils Overlying Massive Granitic Bedrock.

These soils occur on all three tracts of the Experimental Forest but nowhere are they extensive. The slopes on which they have developed have gradients of less than 30 percent. The term "massive granitic bedrock" includes both the nongranitic rocks, such as aplites and porphryies, and the true granitics with which they are closely associated. Highly micaceous rocks are common.

The vegetation on these soils is composed of bitterbrush, ceanothus, chokecherry, rabbitbrush, big sagebrush, eriogonum, yarrow, cheatgrass, annuals, and a few scattered ponderosa pine.

The loam surface horizons are relatively thick. Depth to the massive bedrock is less than 20 inches on the ridges but is commonly 40 inches or deeper on the side slopes. Subsoil textures typically are moderatly fine (sandy clay loam) and are hard when dry. Reaction is typically slightly or moderately acid throughout the solum (surface and subsoil horizons) but in places the subsoil reaction is near neutral.

Side slope position, 24 percent slope gradient, southeast aspect:

A1	0-9"	Grayish brown (10YR 5/2 dry) to very dark grayish brown (10YR 3/2 moist) loam; weak, fine granular; soft, friable, very slightly sticky, slightly plastic; plentiful roots; medium acid (pH 6.0); clear, wavy boundary.
A3	9-16"	Dark brown (10YR 4/2.4 dry) to dark grayish brown (10YR 4/2 moist) loam; weak, medium subangular blocky breaking to moderate fine granular; slightly hard, friable, sticky, plastic; plentiful roots; medium acid (pH 6.0); clear wavy boundary.

B21t	16-30"	Brown (10YR 5/3 dry - 7.5YR 5/4 moist) sandy clay loam; weak, coarse subangular blocky; hard, slightly firm, sticky, plastic; distinct, patchy clay films in the pores; few roots; medium acid (pH 6.0); gradual, wavy boundary.
B22t	30-40"	Brown (10YR 5/3 dry) to pale brown (10YR 6/3 moist) light sandy clay loam; weak, coarse subangular blocky; hard, slightly firm, sticky, plastic; faint patchy clay films on the gravels and in the cavities; few roots; medium acid (pH 6.0); clear, wavy boundary.
C1	40-55"+	Very pale brown (10YR 7/5 dry) to light yellowish brown (10YR 6/4 moist) heavy sandy loam; massive; slightly hard, friable, slightly sticky; medium acid (pH 6.0); highly micaceous; no roots observed.

Midslope position, 22 percent slope gradient, southeast aspect:

A1	0-6"	Brown (10YR 5/3 dry) to dark brown (10YR 3/2.5 moist) loam; moderate, fine granular; soft, friable, sticky, plastic; plentiful roots; clear, wavy boundary.
A3	6-12"	Color as above; heavy loam; very weak, medium subangular blocky breaking to weak, fine granular; soft, friable, sticky, plastic; few roots; few pores; clear, wavy boundary.
B21t	12-18"	Yellowish brown (10YR 5/4 dry) to brown (10YR 4/3 moist) sandy clay loam; very weak medium subangular blocky; slightly hard, friable, sticky, plastic; few roots; common pores; clear, wavy boundary.
B22t	18-24"	Light yellowish brown (9YR 6/4 dry) to brown (9YR 4/3 moist) heavy sandy clay loam; moderate, fine subangular blocky; hard, firm, sticky; faint, patchy clay films in the cavities; few roots; abundant pores; gradual, wavy boundary.
R	24"+	The upper portion of this horizon is 90 percent rock (intermediate porphry) by volume. Some soil material similar to horizon above is in the fissures and between the rock fragments; distinct, broken clay films on the rock faces. The rock is highly weathered.

These soils have been mapped singly only on two small areas in the Bannock Creek-Pine Creek tract. The slopes upon which they have developed are steep and dissected, and some of the surface soils have been eroded.

In the Headquarters and Bear Run tracts, these soils are intermingled with varying amounts of the soils overlying fractured granitic bedrock. Although considerable variation occurs, it is estimated that soil unit No. 6 occupies an average of 65 percent of the 6-2 mapping units (6-2 is the map symbol of this soil complex), soil unit No. 2 occupies about 20 percent, and the remaining 15 percent is occupied by soil unit No. 3, some of which is eroded, plus some unclassified inclusions.

Soil Unit No. 7 - Well-Drained Alluvial Soils.

These soils are on alluvial fans, stream terraces, and high bottomlands. This latter term describes those narrow strips of alluvial land along the main streams. These areas are too low to be classed as stream terraces but their drainage is better than that of many bottomlands.

The vegetation on these soils is tree stands of ponderosa pine and Douglas-fir. The banks of the streams commonly support alder and willow.

The parent material of these soils is, of course, granitic alluvium. Slope gradients vary from 2 to about 20 percent.

Soil description:

South-facing alluvial fan with a 4 percent slope gradient:

O1	1"	Litter, consisting of fresh, partially, and well decomposed layers.
A1	0-3"	Dark grayish brown (10YR 4/1.5 dry) to very dark brown (10YR 2/2 moist) gravelly loam; weak, fine granular; soft, friable, nonsticky; common pores; medium acid (pH 6.0); abrupt, smooth boundary.
A3	3-7"	Pale brown (10YR 6/3 dry) to brown (10YR 4/3 moist) gravelly loam; weak, fine subangular blocky; slightly hard, slightly sticky; common pores; medium acid (pH 6.0); abrupt, smooth boundary.
B1	7-14"	Light brownish gray (10YR 6/2 dry) light clay loam; moderate, fine subangular blocky; hard, sticky; abundant pores; medium acid (pH 6.0); clear, smooth boundary.
B21t	14-45"	Very pale brown (10YR 7/2 dry) to brown (10YR 5/3 moist) gravelly clay loam; some splotches of dark brown (10YR 4/3 dry) below 24"; moderate, medium subangular blocky; hard, sticky, plastic; faint, patchy clay films in the cavities and on the peds; abundant pores; plentiful roots; medium acid (pH 6.0); clear, smooth boundary.

B22t	45-63"	Very pale brown (10YR 7/3 dry) to pale brown (10YR 6/3 moist) gravelly clay loam; weak, medium subangular blocky; hard, sticky, plastic; faint, patchy clay films in the cavities and on the peds; abundant pores; plentiful roots; medium reaction (pH 6.0); clear smooth boundary.
C1	63-67"	Brown (10YR 5/3 moist) gravelly loamy sand; medium acid (pH 5.8) abrupt, smooth boundary.
C2	67-84"	Brown (10YR 5/3 moist) gravelly heavy loam; soft, slightly sticky; medium acid (pH 5.8).

The soils on the river terraces are quite similar to the described profile but the subsoils and substrata of the terrace soils are generally stony or very gravelly. The soils on the high bottomlands are generally more sandy than is shown in the above description, i.e., they have sandy loam surfaces, gravelly loamy sand subsoils, and very gravelly and/or stony substrata.

Soil Unit No. 8 - Imperfectly Drained Alluvial Soils.

These soils support meadow vegetation. Included are eriogonum, penstemon, geranium, bluebell, Oregon grape, bluegrass, and Carex. Willows grow adjacent to the existing stream channel and in the lower-lying depressional areas (old stream channels).

The parent material is granitic alluvium. The slope gradients are less than 5 percent.

Soil description:

A1	0-5"	Grayish brown (10YR 5/2 dry) to very dark grayish brown (10YR 3/2 moist) sandy loam; weak and moderate, fine granular; soft, friable, slightly sticky, slightly plastic; abundant roots; medium acid (pH 6.0); clear, wavy boundary.
A3	5-10"	Dark brown (10YR 3/3 moist) loamy coarse sand; very weak, fine granular; soft, friable, nonsticky; abundant roots; medium acid (pH 6.0); abrupt, wavy boundary.
IIA1	10-13"	Very dark brown (10YR 2/2 moist) sandy loam; weak, fine blocky; slightly hard, slightly firm, slightly sticky, slightly plastic; few roots; medium acid (pH 6.0); abrupt wavy boundary.
IIB1	13-16"	Very dark gray (2.5Y 3/1 moist) sandy clay loam; weak subangular blocky; hard, firm, sticky, plastic; faint, complete clay films in the cavities; few roots; medium acid (pH 6.0); abrupt, wavy boundary.

IIB2t	16-23"	Very dark gray (10YR 3/1 moist) clay; weak blocky; hard, firm, sticky, plastic; faint, broken clay films on the peds; very few roots; medium acid (pH 6.0); gradual, wavy boundary.
IIB3	23-34"	Very dark gray brown (1Y 3/2 moist) sandy clay loam; colors are variegated upon drying; weak, medium blocky; hard, firm, sticky, plastic; faint, broken clay films in the cavities; very few roots; medium acid (pH 6.0); clear, wavy boundary.
IIC1	34-48"+	Dark grayish brown (1Y 4/2 moist) sandy loam; weak fine granular; soft, friable, sticky, slightly plastic; medium acid (pH 6.0).

These imperfectly drained soils were mapped only in the Bear Run tract (Lykow Flat). Included in the mapped area are small amounts of well-drained and poorly drained soils. The term "undifferentiated," which is shown on the soils map, is used to encompass all of the profile variations that commonly occur in alluvial meadows, plus the included soils of the other drainage classes.

Miscellaneous Land Types

Made Land. This land type consists of the dredged alluvial lands--placer tailings--in the Bear Run and Headquarters tracts. The outstanding characteristic of these lands is the very rough, uneven microtopography.

No profile descriptions were made of these materials.

Clay Spots. Small areas of clay soils are in the southeastern portion of the Headquarters tract. These soils occupy areas of gentle relief; slope gradients are less than 10 percent. The parent materials are likely Tertiary lake sediments.

Little time was spent studying these soils because of their very limited extent. Both the surface and subsoil horizons are clay textured. When dry, shrinkage cracks extend through the surface horizons well into the subsoils. In this characteristic, these soils stand out from all others on the Experimental Forest. It is believed that conifers have not been an important component of the vegetation on these swell-and-shrink soils.

SOIL-VEGETATION COMPOSITION RELATIONSHIPS

Nonforested areas are common throughout the Experimental Forest, especially in the eastern part of the Bannock Creek drainage. Evidence on the ground points to the probability that most of these shrub-forb-grass areas (with scattered conifer trees) have long been dominated by herbaceous and/or shrubby plants. This is not to infer that vegetation changes have not occurred in these shrub cover types, but it does seem unlikely that these soils were developed under well-stocked timber stands.

As a group, the soils of the nonforested areas (excepting, of course, the areas upon which the tree canopy unquestionably has been burned or has been harvested) differ in at least two important and significant characteristics from the adjacent soils supporting timber stands. The first of these differences involves the thickness of the surface horizons. The average surface soil thickness of the soils presently supporting shrubs is above twice that of the soils presently supporting forests--12 inches versus 6 inches. This difference is believed to be the result of the greater amount of readily decomposed organic matter produced in the shrub areas compared to that produced in the forested areas.

The second soil difference involves the character of the substratum or bedrock. In those places where the substrata could be well observed and examined, the kind of vegetation (i.e., forest versus nonforest) supported by the overlying soils appeared to be closely related to the physical nature of the bedrock. Forests are on those soils which are underlain by fractured bedrock or rock jointed or weathered so as to readily permit deep percolation of water and the deep penetration of coarse woody roots. Most of the shrub-forb-grass types, on the other hand, are on soils which are underlain by relatively massive bedrock. These massive bedrocks are only locally penetrated by woody roots. The following photos illustrate these two contrasting soil substrata conditions.

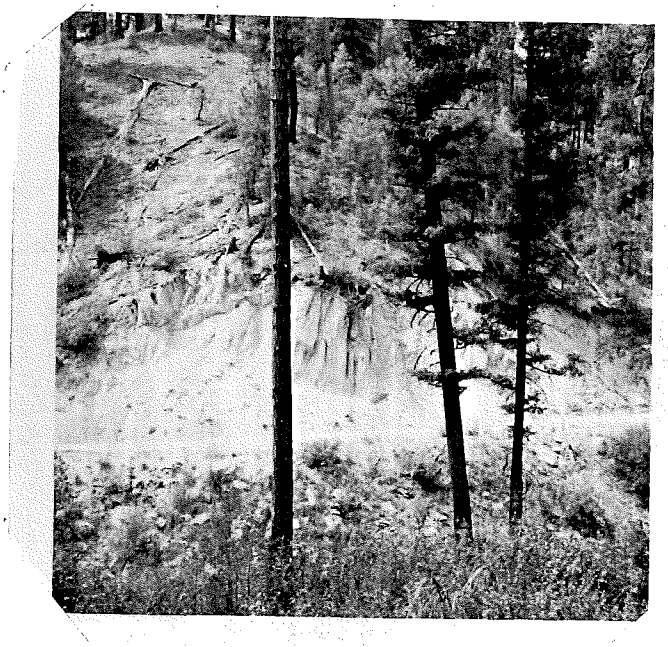


Photo No. 1 - Example of deeply fractured and/or jointed granitic bedrock. The soil mantle is shallow; the tree cover consists of ponderosa pine and Douglas-fir. This is a very common substrata condition, and roots generally can be traced to depths of 10 to 20 feet.

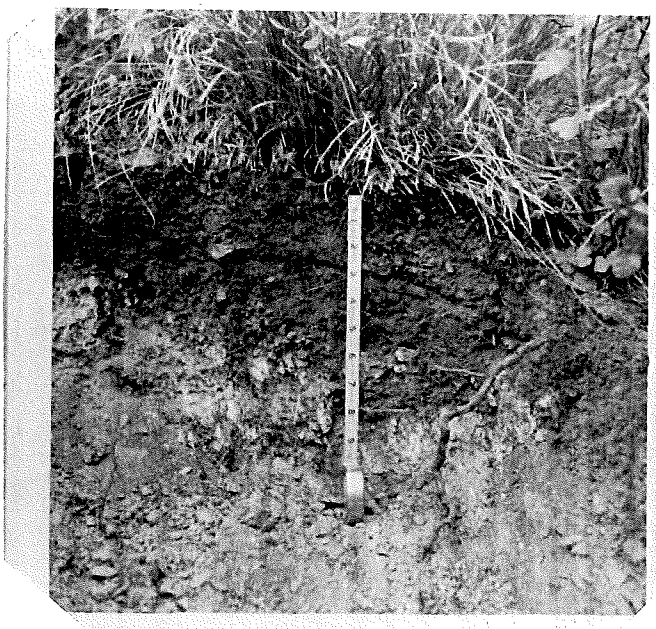


Photo No. 2 - Well shattered granitic bedrock underlying a very shallow soil mantle. Note the coarse woody roots that penetrate the substratum. The tree overstory is ponderosa pine.

Photo No. 3 - Typical example of vertical fracturing of the granitic bedrock as observed in a road cut. Tree overstory consists mainly of ponderosa pine.

Photo No. 4 - Example of fractured, relatively hard granitic bedrock. The rocks occur at very shallow depths but still support an overstory of Douglas-fir.

Photo No. 5 - Landscape view of a typical shrub-forb-grass vegetation area.

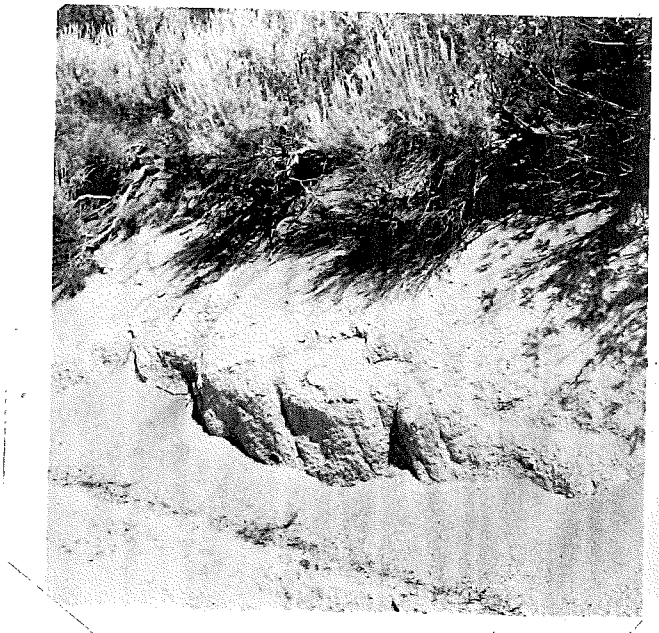


Photo No. 6 - Example of massive granitic bedrock underlying the area shown above. Bedrock of this nature is penetrated only locally by roots.

Photo No. 7 - Another landscape view of the shrub-forb-grass vegetation area.

Photo No. 8 - Soil profile in the landscape shown above. The tape is slightly more than four feet in length. Note the massive granitic bedrock at the bottom of the tape. This is not penetrated by roots. A relatively thin layer of the bedrock (from 32 to 48 inches) is broken up and contains soil material and roots.

Bedrock characteristics are difficult to examine under most of the soils. The above observations, however, strongly indicate that the forests in this area are associated with effectively deep sites (a soil mantle plus a permeable and root-penetrable substratum); the shrub types with scattered trees are associated with relatively shallow sites (rooting generally restricted to the soil mantle).

Soil substrata differences (and hence soil differences) may aid in explaining the variability in survival of planted stock in some past tree planting trials. Some of the most complete failures occurred in the shrub-covered areas on what appeared to be excellent sites for tree planting as indicated by the thickness of the dark surface soils. On the soils underlain with massive bedrock (natural shrub supporting areas), thick dark surface soils are indicative of the herbaceous or shrub productivity potential but not of the conifer potential.

SOIL-VEGETATION PRODUCTIVITY RELATIONSHIPS

The second important soil-vegetation relationship observed involves some soil-productivity relationships concerning the trees. Based on height-age measurements of suitable trees, the ranges in site index 6/ for ponderosa pine on the important timber-producing soils are about as follows:

Soil Unit	Site Index (Height in feet at 100 yrs.)
No. 1	60-90
No. 2	70-105
No. 3	70-120
No. 7	90-120

Two of the more important factors associated with site index differences within the soil units include variations in soil depth (depth to the bedrock) and variations in the physical nature of the bedrock. The characteristics of the bedrock are difficult to appraise, but considerable local variation exists in degree of weathering and fracturing of the bedrock which in turn directly influences the moisture and rooting qualities of the rock material.

6/ Site index determinations based on U.S.D.A. Technical Bulletin No. 630, Meyer, W. J. 1938. Yield of Even-Aged Stands of Ponderosa Pine.

SOIL-TIMBER REGENERATION RELATIONSHIPS

Based on field observations during the survey, pine and fir regeneration comes most readily on the soils of units 3 and 7. The subsoils of these soil units have relatively high moisture-holding capacities, and once rootlets have reached these horizons, seedling establishment, regardless of aspect, is more or less assured.

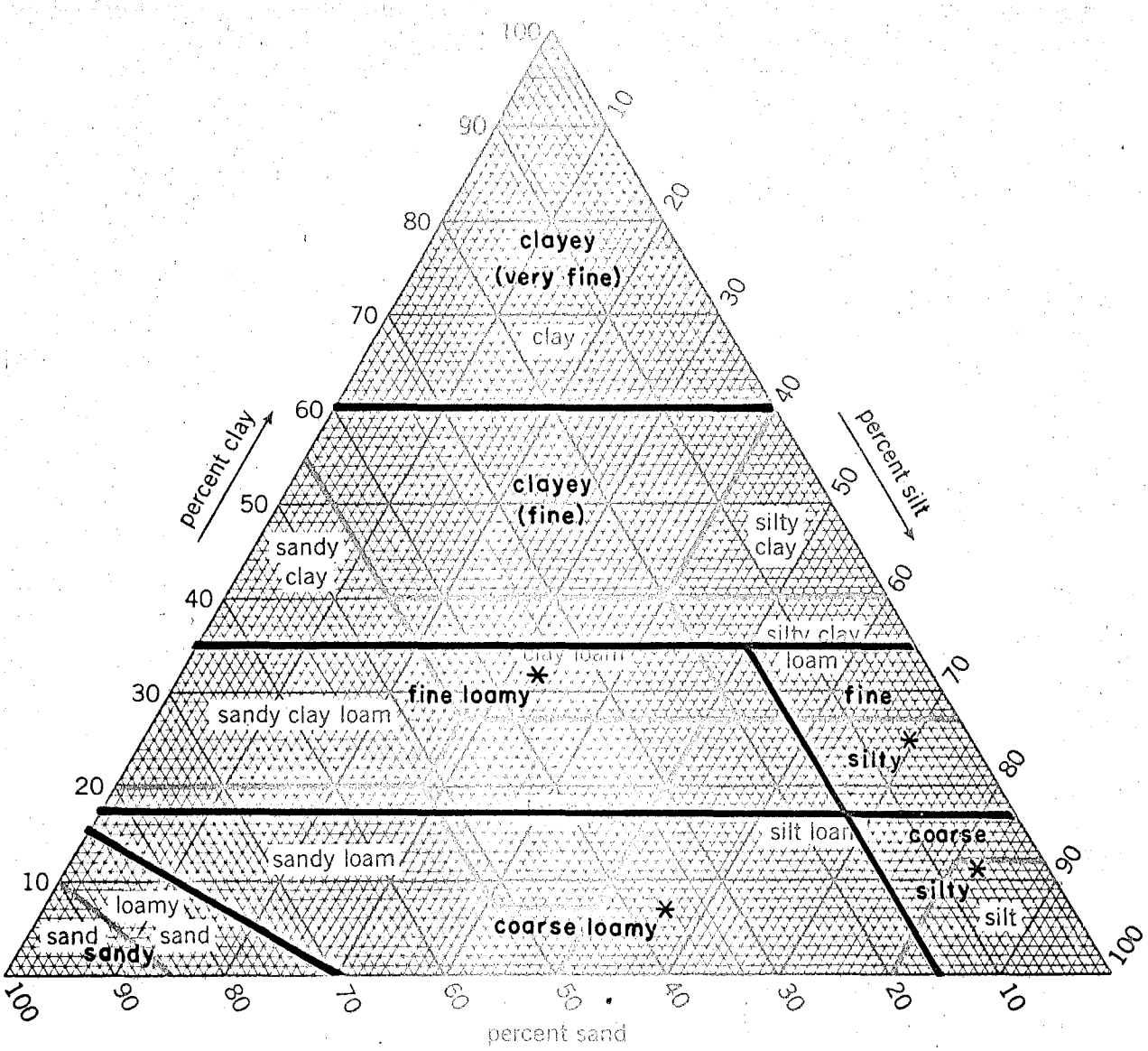
Of the soils capable of supporting forests, the soils of unit No. 1 are perhaps the most erratic in their behavior in regard to natural seedling establishment. Seedling rootlets must pass through horizons of decreasing moisture-holding capacity as they grow downward into and/or through the coarser textured subsoil or subsurface layers. Perhaps years wetter than most or more favorable than most are needed to successfully establish seedlings on these soils--especially on southerly aspects.

As mentioned in other sections of this report, there are indications that the fractured bedrock substrata under the sandy and coarse loamy soils furnish significant quantities (or significantly timed amounts) of moisture to the trees. In fact, there is some evidence to believe that a rootlet has a better chance of obtaining a dependable source of moisture in some bedrock strata than in some of the loose, coarse sandy layers in the soil mantles above.

The behavior of seedlings on the soils of unit No. 2 falls between the two extremes mentioned above but appears to be more like the sandy soils than the fine loamy soils.

APPENDIX

GUIDE FOR TEXTURAL CLASSIFICATIONS



* Very fine sand (0.05 – 0.1) is treated as silt for family groupings; coarse fragments are considered the equivalent of coarse sand in the boundary between the silty and loamy classes.

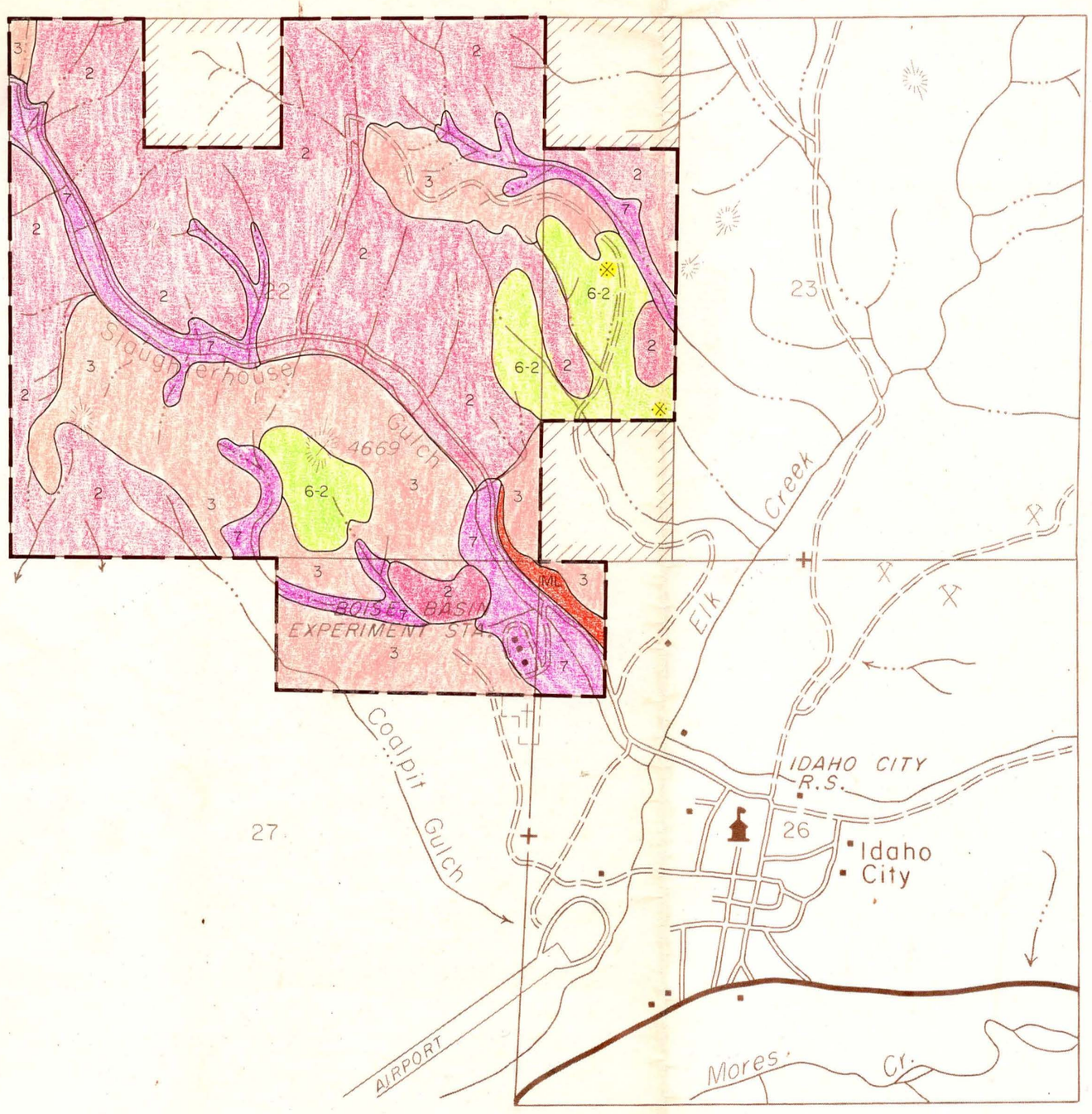
Texture classes (names and class limits show in half tones on the triangle) - standard U.S.D.A. names such as "sandy loam," "clay loam," and "clay." These classes are used in the soil descriptions (horizon by horizon).

Texture groups (names and group limits show in full tones) - new U.S.D.A. names such as "coarse loamy" and "fine loamy." These groups are used for the soil unit nomenclature.

HORIZON NOMENCLATURE

O1	Organic horizon (litter layer) in which the original form of most vegetative and animal matter is visible to the naked eye.
O2	Organic horizon (litter layer) in which the original form of most plant and animal matter cannot be recognized with the naked eye.
A1	The mineral horizon that has an accumulation of organic matter at or adjacent to the surface; commonly referred to as "surface" soil.
A11, A12, A13	Subdivisions of the A1 horizon, variously based on slight differences in color, structure, texture, or other morphological characteristics.
A2	The mineral horizon in which the loss of iron, aluminum, or clay is emphasized and which results in concentration of quartz or other resistant minerals of sand and silt sizes. This horizon is most often distinguished by its lighter color and coarser texture compared to the horizons above and below. Sometimes referred to as the "subsurface" horizon.
A2 & B2t	A horizon qualifying for A2 except that included layers constituting less than 50 percent but more than 10 percent qualify as B2t.
A3	A transition horizon between the A and B, but more like the A than the B.
AC	A transition horizon between the A and C in those soils in which a B horizon is lacking.
B1	A transitional horizon between the A and B but more like the B than the A.
B2t	The mineral horizon in which an accumulation of silicate clay (translocated) is emphasized. The subscript "t" is used to indicate a <u>textural</u> B as opposed to other kinds of B horizons such as Bir (illuvial iron), Bca (carbonates), Bh (humus), etc. Commonly referred to as "subsoil."
B21t, B22t	Subdivisions of the B2t horizon based on slight variations of color, texture, structure, and/or other morphological characteristics.

B3	A transitional horizon between B and an underlying horizon (usually C or R) but more like the B horizon than the underlying horizon.
C	Mineral horizons or layers relatively little affected by pedogenic processes and lacking properties diagnostic of A or B but including material modified by weathering outside the zone of major biological activity. C1 and C2 are unconsolidated materials which differ from each other in any number of physical characteristics; the numerals 1 and 2 are indicative only of vertical sequence within the C. As C is presently defined, it may or may not be like the presumed parent material. Commonly referred to as the "substratum" or "upper substratum."
CR	A transitional horizon between C (unconsolidated material) and R (consolidated rock) but more like the C than the R. In this survey, CR is used for those layers that are apparently deeply fractured, generally well-weathered (can be cut with a shovel), are readily penetrated by water and roots (tree roots penetrate to depths of 10 feet or more as observed in road cuts), but retain much of the fabric or original appearance of the rock formation.
R	Consolidated bedrock underlying the soil mantle or regolith. Where observed in the survey area, R may be weathered but is relatively massive and apparently not easily penetrated by water or roots.
R & B2t	A horizon qualifying as R except that included portions constituting less than 50 percent but more than 10 percent qualify as B2t.
II	Roman numerals are prefixed to the appropriate horizon designations when it is necessary to number a series of layers of contrasting material consecutively from the surface downward. The contrasting material in the alluvial soil in which this symbol is used is a buried soil.



LEGEND

Mapping Symbol	
2	Coarse loamy soils overlying fractured granitic bedrock
3	Fine loamy soils overlying fractured granitic bedrock
6-2	Fine loamy soils overlying massive granitic bedrock and coarse loamy soils overlying fractured granitic bedrock, undifferentiated
7	Well drained alluvial soils, undifferentiated
ML	Made Land
※	Clay Spot
	Local topog.
— —	Experimental Forest Boundary
═══	Paved Highway
═══	Dirt Road
═ ═	Primitive Road
	Ranger Station
~	Perennial Drainage
~···~	Intermittent Drainage
X	Mine

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Soils Map of the HEADQUARTERS UNIT

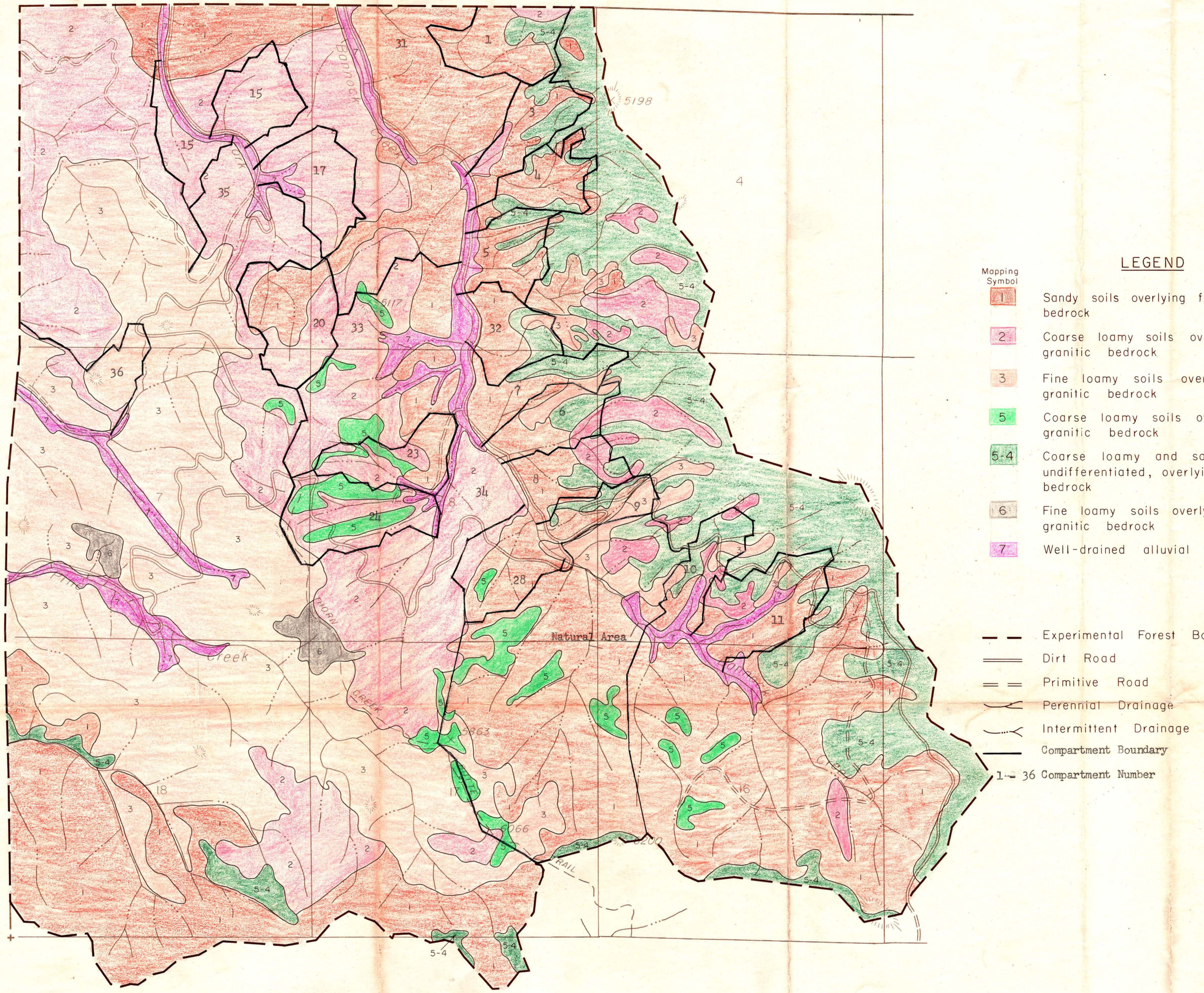
BOISE BASIN EXPERIMENTAL FOREST

T. 6 N., R. 5 E., Boise Meridian

IDAHO
1965

0 1/4 1/2 3/4 1 Mile
Scale

Enlarged from edited Planimetric Quadrangles, Scale 1:31680



LEGEND

Mapping Symbol	
1	Sandy soils overlying fractured granitic bedrock
2	Coarse loamy soils overlying fractured granitic bedrock
3	Fine loamy soils overlying fractured granitic bedrock
5	Coarse loamy soils overlying massive granitic bedrock
5-4	Coarse loamy and sandy soils, undifferentiated, overlying massive granitic bedrock
6	Fine loamy soils overlying massive granitic bedrock
7	Well-drained alluvial soils, undifferentiated

- Experimental Forest Boundary
- Dirt Road
- Primitive Road
- Perennial Drainage
- Intermittent Drainage
- Compartment Boundary
- 1 – 36 Compartment Number

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Region 4, Ogden, Utah

Soils Map of the BANNOCK CREEK—PINE CREEK UNIT

BOISE BASIN EXPERIMENTAL FOREST
T. 5 N., R. 6 E., Boise Meridian

IDAHO
1965

0 1/4 1/2 3/4 1 Mile
Scale

Enlarged from edited Planimetric Quadrangles, Scale 1:31680

LEGEND

Mapping Symbol	
1	Sandy soils overlying fractured granitic bedrock
2	Coarse loamy soils overlying fractured granitic bedrock
3	Fine loamy soils overlying fractured granitic bedrock
4	Sandy soils overlying massive granitic bedrock
6-2	Fine loamy soils overlying massive granitic bedrock and coarse loamy soils overlying fractured granitic bedrock, undifferentiated
7	Well drained alluvial soils, undifferentiated
8	Imperfectly drained alluvial soils
ML	Made Land

- Experimental Forest Boundary
- Dirt Road
- Primitive Road
- Perennial Drainage
- Intermittent Drainage

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Forest Service
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Soils Map of the BEAR RUN UNIT

BOISE BASIN EXPERIMENTAL FOREST

T.6N., R.5E., & R.6E., Boise Meridian

IDAHO
1965

0 — 1/4 — 1/2 — 3/4 — 1 Mile
Scale

from edited Planimetric
s, Scale 1:31680